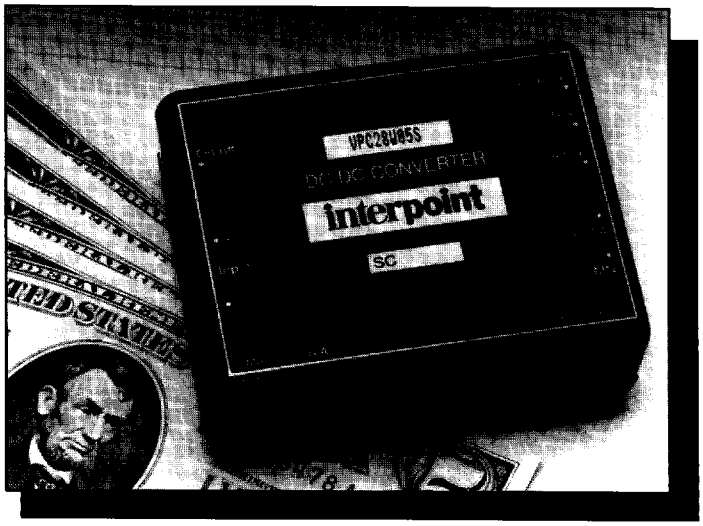
VPC Series DC/DC Converters



General Description

The VPC Series™ DC/DC converters, members of Interpoint's Value/Performance family, feature a wide input range of 20 to 72 VDC with up to 45 watts of output power, single output voltages of 3.3, 5, 12 and 15 VDC and up to 81% efficiency. These output voltages are accurate within 1%. The case operating temperature of -40°C to +85°C exceeds the usual commercial operating range.

Converter Design

VPC DC/DC converters use a single-ended forward topology with current mode pulse-width modulation. Switching frequency is typically 220 kHz. Input and output filtering eliminate the need for external components. Magnetic coupling electrically isolates the input from the output by 700 VDC.

Protection Features

The VPC Series includes several features to protect your system and the converter. Input circuitry protects against transients of up to 80 VDC for 100 milliseconds. Independent pulse-by-pulse current limiting provides short circuit protection from positive output to output common. To prevent damage from overheating, a thermal shutdown occurs at 100°C (case). The converter will resume normal operation when the case temperature falls below 100°C.

Regulation and Noise

An audio rejection of greater than 25 dB for DC to 120 Hz reduces power line noise. Input ripple measures 45 mA p-p over a DC to 20 MHz bandwidth. Filtering and control circuitry reduce output voltage fluctuations with load regulation of 0.01%, line regulation as low as 0.1%, and output noise as low as 25 mV p-p, depending on the model. If input common and output common are to be connected, a 3.3 to 10 µF, 0.5 to 5 ohm ESR capacitor connected across the output terminals (pins 6 and 7) will reduce switching noise.

On/Off, Sense, and Trim

On/off, sense, and trim functions provide versatility. The on/off terminal (pin 8) can be driven with an open collector/drain or a relay and is referenced to the negative input. Disabling the pulse-width modulator with a low on pin 8 turns the converter off. In this mode, the converter will draw 7 mA. The on/off terminal may be left floating if not used.

For a wide trim range of ±10% on all models, pin 4, the trim terminal, can be used with either a trim pot or a fixed resistor across the sense terminals (pins 3 and 5). Additionally, the 12 and 15 volt output models may be trimmed down to 72% and 65% of output voltage, respectively. Pin 4 may be left floating if not used. Internal circuitry provides extra protection by limiting the power to the maximum non-trimmed specification. When trimming increases the output voltage, the output current is reduced proportionally. When trimming decreases the output voltage, the output current will not exceed the maximum rating.

To use the sense terminals to correct for line drops of up to 0.6 volts, connect the positive sense (pin 3) to the positive side of your load and the negative sense (pin 5) to the negative side of your load. If not used, the sense terminals should be connected to their respective output terminals (pin 6 to pin 3 and pin 7 to pin 5).

Packaging

The 3.01 by 2.58 by 0.83 inch package weighs 199 grams and is water washable. This five sided copper package measures 0.025 inches (0.635 mm) thick, providing both EMI shielding and heat sinking. The case shield connects to the input common (pin 2).

Note: The above paragraphs refer to typical specifications. See characteristics chart for detailed information.

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interpoint
PREMIER POWER SOLUTIONS

VPC Series DC/DC Converters

- Up to 45 watts output power
- Efficiencies up to 81%
- Single outputs of 3.3, 5, 12, or 15
- Sense terminals to adjust for line drops
- Wide input range of 20 to 72 VDC
- Trimmable output
- On/off function
- -40°C to +85°C operating temperature
- No external components necessary
- Five-sided, shielded, low-thermal gradient copper case

To order, call
1-800-822-8782

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CHARACTERISTICS: Tc = 25°C, nominal input voltage, full load unless otherwise specified.

Operating Temperature Range (Case)
- Full Power: -40°C to +85°C
- Absolute: -55°C to +100°C

Storage Temperature Range (Case)
- -55°C to +100°C

Thermal Impedance: case rise over ambient
- 4.4°C/watt dissipated

Thermal Shutdown
- 100°C case

Temperature Coefficient
- 50 ppm / °C typ., 150 ppm / °C max.

Weight
- 199 grams, typical

Isolation: leakage < 10 µA
- Input to output: 700 VDC

Capacitance
- Input to output: 500 pF, typical

Conversion Frequency
- 220 kHz, typical

Audio Rejection
- <25 dB DC to 120 Hz, amplitude of 1% V_{in}

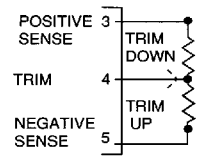
Start-up Time
- 25 milliseconds, typical

On/Off (pin 8)
- Open circuit voltage = 2.5 VDC
- Output enabled = open or high (≥4 VDC)
- Output disabled = low (≤1.5 VDC), input current is typically 7 mA

Resistance
- On/Off (pin 8): 6 k ohms
- Trim (pin 4): 10 k ohms

PARAMETER	CONDITIONS	VPC28W03R3S			VPC28W05S			VPC28W12S			VPC28W15S			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUT VOLTAGE	NORMAL	20	28	72	20	28	72	20	28	72	20	28	72	VDC
	TRANSIENT (100 ms)	—	—	80	—	—	80	—	—	80	—	—	80	
INPUT CURRENT	NO LOAD	—	10	—	—	10	—	—	10	—	—	10	—	mA
	FULL LOAD	—	1100	—	—	1810	—	—	1910	—	—	1910	—	
OUTPUT VOLTAGE [1]	NOMINAL INPUT V	3.30	3.33	3.36	4.95	5	5.05	11.90	12	12.10	14.9	15	15.10	VDC
OUTPUT CURRENT	FULL LOAD	1.5	—	7	0	—	8	0	—	3.75	0	—	3	A
OUTPUT POWER	FULL LOAD	—	—	23.3	—	—	40	—	—	45	—	—	45	W
EFFICIENCY	FULL LOAD	—	76	—	—	79	—	—	81	—	—	81	—	%
LINE REGULATION	V_{in} = MIN TO MAX	—	0.5	2.0	—	0.1	0.2	—	0.1	0.2	—	0.1	0.2	%
LOAD REGULATION	25% TO FULL LOAD	—	0.01	0.1	—	0.01	0.1	—	0.01	0.1	—	0.01	0.1	%
OUTPUT RIPPLE [2]	0 to 20 MHz	—	25	—	—	50	—	—	50	—	—	50	—	mV p-p
	10 kHz to 1 MHz	—	10	—	—	10	—	—	10	—	—	10	—	mV rms
INPUT RIPPLE [3]	0 to 20 MHz	—	45	—	—	45	—	—	45	—	—	45	—	mA p-p
	10 kHz to 1 MHz	—	5	—	—	5	—	—	5	—	—	5	—	mA rms
TRANSIENT	RECOVERY [4]	—	500	—	—	100	—	—	100	—	—	100	—	µs
	RESPONSE [5]	—	200	—	—	250	—	—	120	—	—	120	—	mV pk

Notes:
1. A fixed resistor of any value or a trimpot may be used to adjust the output voltage. If using a trimpot, use 10 k ohms for the 3.3 or 5 volt models and 20 k ohms for the 12 or 15 volt models.
2. To simulate normal PCB decoupling, a 0.01 µF ceramic capacitor and a 10 µF tantalum capacitor are placed one inch from the converter when measuring output noise.
3. Input ripple is measured into a 10 µH source impedance.
4. The time required to settle from a 50% to 75% step load change to within a 1% error band with a steprise time of 2µs.
5. The peak overshoot during a transient as defined in note 4.



TRIM CONNECTION

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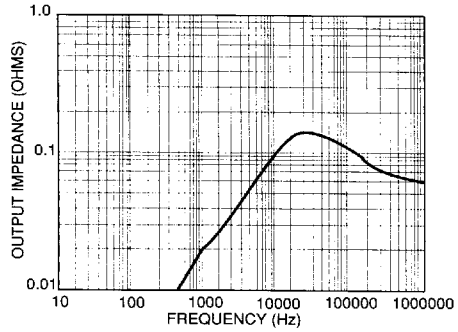
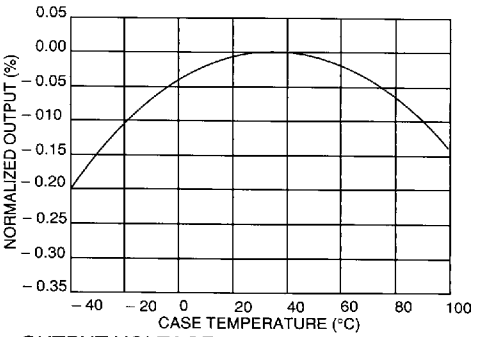
TYPICAL PERFORMANCE CURVES (ALL MODELS UNLESS OTHERWISE NOTED)



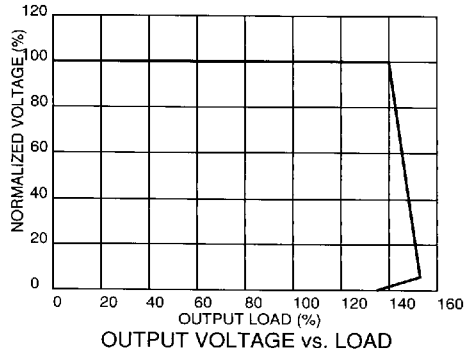
OUTPUT IMPEDANCE vs. FREQUENCY

Figure 1



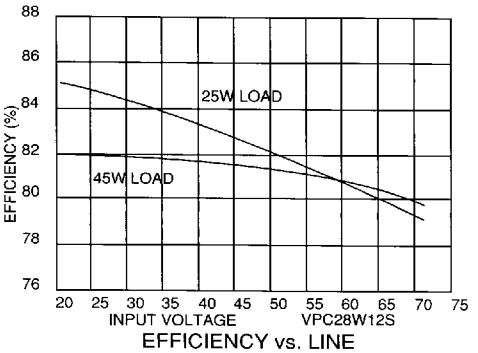
OUTPUT VOLTAGE vs CASE TEMPERATURE

Figure 2



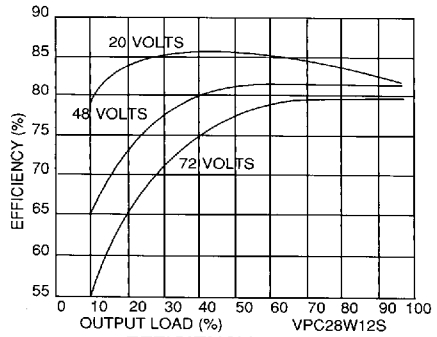
OUTPUT VOLTAGE vs. LOAD

Figure 3



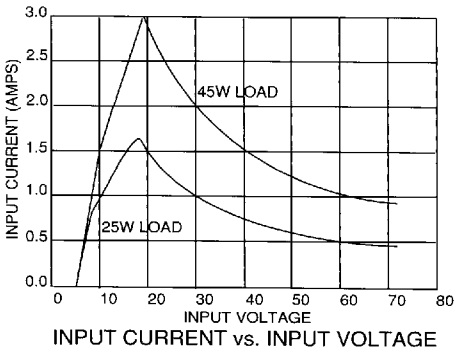
EFFICIENCY vs. LINE

Figure 4



EFFICIENCY vs. LOAD

Figure 5



INPUT CURRENT vs. INPUT VOLTAGE

Figure 6

NOTE:
The efficiency curves were generated for 12 volt output models (figures 4 and 5).
For other output models use the following adjustments:

For the 3.33 volt output models, subtract approximately 4%
For the 5.0 volt output models, subtract approximately 3%
For the 15.0 volt output models, subtract approximately 1%

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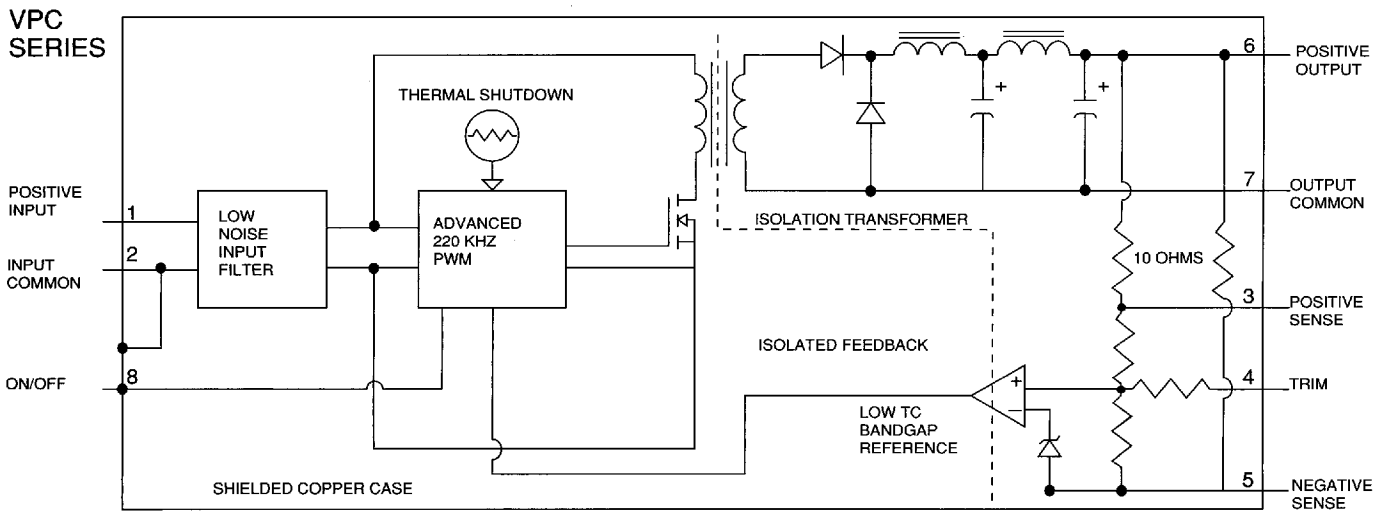
OPTIONAL ENVIRONMENTAL SCREENING

Environmental screening consists of the following procedures (Methods and Conditions refer to MIL-STD-202):

- 96 hours of burn-in at 85°C, per method 108.
- Mechanical shock per method 213, condition D.
- Temperature shock per method 107, condition A (modified).
- Final electrical test per Interpoint acceptance test procedure.

To order optional screening, add suffix -/ST to model number. Example: VPC28W05S/ST. On unscreened parts, the screening code block is blank. On screened parts, the block is marked "ST."

BLOCK DIAGRAM

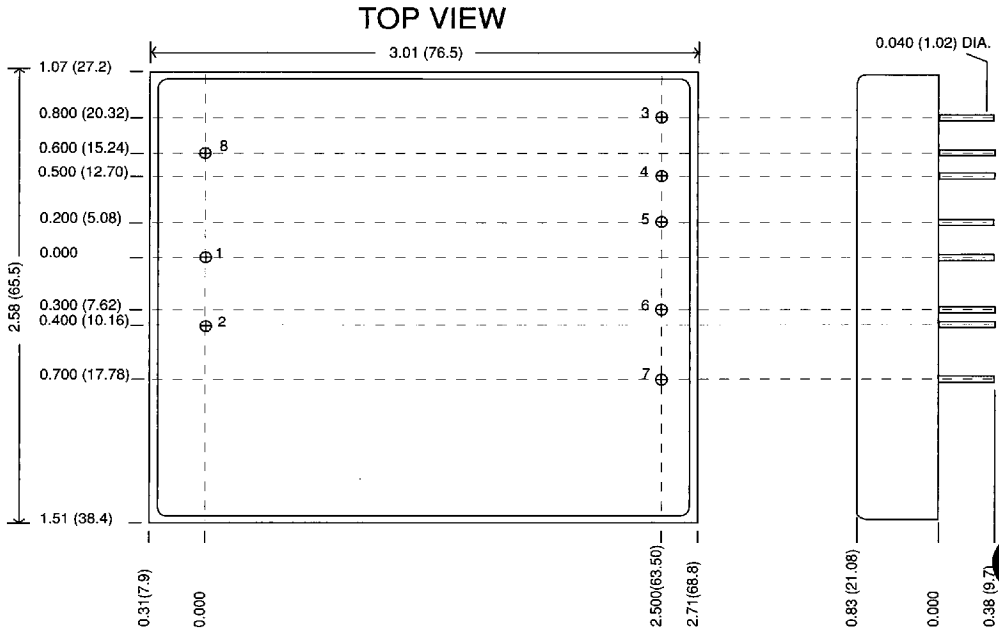


METAL AND EPOXY CASE

VPC SERIES CASE DRAWING
NOMINAL CASE DIMENSIONS IN INCHES (MM)
TOLERANCE X.XX ±00 (0.51), X.XXX ±0.005 (0.13)

Designation	Pin #
Positive input	1
Input common	2
Positive sense	3
Trim	4
Negative sense	5
Positive output	6
Output common	7
On/off	8

Note: Case is connected to input common (pin 2).



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